Diabetes mellitus – effect of omega-6 PUFA on ADMA and hormones of the regulation of inflammatory reactions.

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LIFESTYLE, OXIDATIVE STRESS AND DIABETES MELLITUS

Diabetes mellitus (DM)

• chronic metabolic disease associated with increased oxidative stress and inflammation
• hyperglycemia - ↑ production of ROS, inflammatory mediators, glycation of proteins and ↓ antioxidative status
• chronic diabetic complications:
  1. microvascular – nephropathy, retinopathy, neuropathy
  2. macrovascular – atherosclerosis, endothelial dysfunction, hypertension → cardiovascular diseases
ADMA (asymmetric dimethylarginine)

- a new risk factor of cardiovascular diseases in diabetic patients
- endogenous competitive inhibitor of NO synthase

(Landim et al., 2009)
Adiponectin

- hormone which is synthetized and secreted in the adipose tissue, liver, skeletal muscle, cardiomyocytes, spleen and kidney
- anti-diabetic effects: ↑ insuline sensitivity, regulation of energy and glucose metabolism
- anti-atherogenic effects: ↓ foam cell production, ↓ subendothelial lipid accumulation, promote vasodilatation (↑ NO)
- anti-inflammatory effects: ↑ expression of anti-inflammatory cytokines (IL-10), ↓ expression of pro-inflammatory cytokines (IL-6, TNFα)
**Omega-6 polyunsaturated fatty acids (PUFA)**

- natural vegetable oils
- essential fatty acids
- linoleic acid (LA, C18:2), arachidonic acid (AA, C20:4)
- sources: nuts, seeds, sunflower oil, corn oil, soybean oil, eggs
Protocol of the study

**Aim of study:** to examine the effect of omega-6 PUFA intake on the level of ADMA and adiponectin in the plasma of healthy and diabetic rats

**Material:** male Wistar rats old 5-6 weeks were divided into 4 groups:

- **K** – healthy control rats; n = 7
- **KOC2** – healthy control rats + omega-6 PUFA; n = 8
- **D** – diabetic rats; n = 11
- **DOC2** – diabetic rats + omega-6 PUFA; n = 9

- DM was induced by STZ in the dose 50 mg/kg of weight
- oil with the content of omega-6 PUFA was administrated in the dose 400 mg/kg/day for 7 weeks
- compound of the oil:
  
<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>C16:0</td>
<td>7.0% (palmitic acid)</td>
</tr>
<tr>
<td>C18:0</td>
<td>2.5% (stearic acid)</td>
</tr>
<tr>
<td>C18:1</td>
<td>15.6% (oleic acid)</td>
</tr>
<tr>
<td>C18:2</td>
<td>64.5% (linoleic acid)</td>
</tr>
<tr>
<td>C18:3</td>
<td>10.4% (linolenic acid)</td>
</tr>
</tbody>
</table>

**Methods:** ADMA and adiponectin were measured in the plasma of rats by the ELISA method.
The effect of omega-6 PUFA intake on ADMA

average values ± SD
* p < 0.05 statistically significantly difference compared to D

- significantly increased level of ADMA in the plasma of diabetic rats which received omega-6 PUFA compared to diabetic rats
The effect of omega-6 PUFA intake on adiponectin

- adiponectin was not significantly influenced by intake of omega-6 PUFA in healthy as well as diabetic rats
Conclusions

- we found out significantly increased level of ADMA in diabetic rats which received oil with the content of omega-6 PUFA compared to diabetic rats

- it could be explained by pro-oxidative effects of omega-6 PUFA which can be substrates for inflammatory mediators – eicosanoids and under the conditions of increased inflammatory activity oxidative stress can be increased as well

- enzyme responsible for the degradation of ADMA, dimethylarginine dimethylaminohydrolase (DDAH), is sensitive to damage caused by oxidative stress and reduced activity of DDAH can cause elevated level of ADMA
References:

- Suresh, Y. et al.: Nutrition, 2003, 19, 93-114
- Szuba, A., Podgórski, M.: Pharmacological reports, 2006, 58, 16-20
Thank you for attention!